DISSERTATION

FOR THE AWARD OF DEGREE

MASTER OF SCIENCE

SESSION 2022-2024

SENSORY NERVE CONDUCTION STUDY FOR TIBIAL AND SURAL NERVE AMONG DIABETIC AND HEALTHY PEOPLE

By

S LAKSHMI PRABHA., M.sc MEDICAL PHYSIOLOGY

DEPARTMENT OF

PHYSIOLOGY

SANTOSH DEEMED TO BE UNIVERSITY

NO. 1, SANTOSH NAGAR, GHAZIABAD-201009,

DELHI NCR, INDIA

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I hereby declare that this dissertation title **SENSORY NERVE CONDUCTION STUDY FOR TIBIAL AND SURAL NERVE AMONG DIABETIC AND HEALTHY PEOPLE** is a bonafide genuine research work carried out by me under the esteemed guidance of my Guide **DR. Manisha Gupta** Department of physiology, Santosh Deemed to be University, Ghaziabad, (U.P)

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This is to certify that the dissertation title **SENSORY NERVE CONDUCTION STUDY FOR TIBIAL AND SURAL NERVE AMONG DIABETIC AND HEALTHY PEOPLE** is a bonafide genuine research work carried out by **Ms. S LAKSHMI PRABHA** in partial fulfilment of the requirement for the degree of M.Sc Medical Physiology under my supervision and guidance in department of physiology Santosh Deemed to be University, Ghaziabad, (U.P).

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CERTIFICATE BY THE CO-GUIDE/S

This is to certify that the dissertation title **SENSORY NERVE CONDUCTION STUDY FOR TIBIAL AND SURAL NERVE AMONG DIABETIC AND HEALTHY PEOPLE** is a bonafide genuine research work carried out by **Ms. S LAKSHMI PRABHA** in partial fulfilment of the requirement for the degree of M.Sc Medical physiology under my supervision and guidance in department of physiology Santosh Deemed to be University, Ghaziabad, (U.P)

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This is to certify that the dissertation title **SENSORY NERVE CONDUCTION STUDY FOR TIBIAL AND SURAL NERVE AMONG DIABETIC AND HEALTHY PEOPLE** is a bonafide genuine research work carried out by **Ms. S LAKSHMI PRABHA** himself under the esteemed guidance of Dr. Manisha Gupta Santosh Deemed to be University, Ghaziabad, (U.P)

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INTRODUCTION

Diabetes mellitus (DM) is one of the most common and chronic disease in human. Above 400 million people live with diabetic this would have risen to 500 million by 2030. DM cause 4.6 million death in 2011. Diabetes is more in India then other western countries and this is believed to increase further in the future years. The prevalence of people with diabetes increases every year due to population growth, ageing, obesity, sedentary lifestyle and food habits that leads to many complications. [3]

It is a group of metabolic disease characterized by hyperglycemia with the defects of insulin secretion, insulin action or both. Many pathogenic processes are involved in diabetes [11]. The pancreatic beta cell failure leads to insulin deficiencies to abnormalities results insulin resistance. That leads to decrease in glucose transport in to the liver, muscles cell and fat cells. The long-term diabetes may damage many organs and it maybe life threatening. [12]

The major types of diabetes are Type I and Type II diabetic. Type II diabetes is most common type in adults its prevalence increasing all over the world. All over the world 90% - 95% of diabetic people have Type II diabetes.

Type II DM is a non-insulin dependent DM. This type of DM most common in obesity patients or who have more body fat in the abdominal region. The Type II DM results from multi-gene

predisposition and environmental triggers. The environmental triggers are obesity, cigarette smoking, alcohol, physical inactivity etc. The strong genetic predisposition of DM increases the risk of Type II DM[3].

The people with DM are at increased risk of cardio-vascular disease, cerebrovascular disease, peripheral neuropathy, ulcers, retinopathy, ulcers (commonly in foot), gastrointestinal problems and non-alcoholic fatty liver disease etc [25].

The common complications of DM are autonomic and peripheral neuropathy. The half of DM people have neuropathy. There are several types of neuropathies including mono-neuropathy, multifocal neuropathy and peripheral neuropathy. The incidence of diabetic neuropathy (DN) is more common form of peripheral neuropathy that cause non-traumatic amputation. [2]

Diabetic neuropathy is a major cause of disability and reduced quality of life as a result of sensory loss, pain, gait disturbance, fall-related injury & foot ulceration and amputation. The main two causes of diabetic neuropathy are insulin resistance and hypertension. Obesity is common in DN patients. The other causes are metabolic syndrome, B12 deficiency, inherited conditions, smoking, alcohol and old age.[2][1]

A study of south India reported that 19.1% of DM people have diabetic neuropathy. Diabetic neuropathy affects both autonomic and peripheral nervous system. The most common diabetic neuropathy

is distal symmetric polyneuropathy. The distal symmetric polyneuropathy most commonly affects hands and lower limb. [5]

There are many causes for distal symmetric polyneuropathy but10-20% of cases are idiopathic. These targets sensory and motor axons.Distal symmetric polyneuropathy is a length dependent neuropathy its start from distal nerve endings and spread towards proximal mostly in the longest neurons of limbs. That cause ‘stocking and glove’ in the limbs which increases risk of falls and sleep disturbance. The prolonged neuropathy may lead to foot ulceration that end to foot amputation. [1][2]

The characteristics are dysfunction of myelinated and unmyelinated peripheral neurons. The Schwann cells are targeted by chronic hyperglycaemia. Then Schwann cells and myelin breakdown may cause several alterations in the axons. Axonal transport and signalling are disturbed because of Schwann cells damage. That occur in the length-dependent manner, first starts in longest nerve distal axons of lower limbs and dying back towards the cell bodies.[3]

The persistently elevated glucose level leads to glycation of proteins. Advanced glycation end products (AGEs) formed through protein glycation that leads to formation of nodules, contracture, demyelination and microvascular damage. That may cause musculoskeletal damage like trigger finger, limited joint mobility, frozen shoulder, dupuytren’s contracture. The 50% of diabetic neuropathy leads to foot ulcer.

The symptoms of peripheral neuropathy are

- Numbness or pain sensation in a stocking and glove distribution in the extremities
- Reduced vibration sense
- Tingling, burning sensation to pain in feet called "burning feet syndrome"
- Sensory disturbance (strange feeling like walking on cotton)
- Inability to detect thermal differences.

The peripheral neuropathy particular starts at feet usually more at night with high sensation of pain. Sensation loss is more peripheral sock-like nature in beginning. The Achilles tendon reflex may impair and sometimes patellar reflex also affect. Achilles tendon reflex is an early sign of motor neuropathy. Later stage some may have muscle weakness. The overpressure during loss of sensation (like wearing tight shoes, direct sharp injury) leads to foot ulceration. [2]

The foot is the essential part of the body for mobility, balance, coordination for all Activities of daily living. The complications of neuropathy affect the feet mostly in T2DM that leads to amputation. Non-traumatic amputation is more common in diabetic neuropathy. The amputation in diabetes patients affects the quality of life and low life

expectancy. Therefore, early detection of DSPN is essential for management and avoid further complication.

There are lots of research conducted using nerve conduction study among diabetic people and non-diabetic people. But for tibial and sural sensory is not common. Tibial and sural nerve is the common sensory nerves in foot. So, nerve conduction study for tibial and sural nerve among diabetic people is more important to prevent further complication. Age and duration of diabetes impact on tibial and sural nerve not clear.[4]

The diagnosis for peripheral neuropathy is physical examination, nerve conduction studies (NCS), electromyography (EMG) and nerve biopsy. But NCS is the gold standard for peripheral neuropathy.

Nerve conduction study (NCS): -

NCS is the common method used to study the nerve conducting velocity. It is a non-invasive procedure that nerves are stimulated by a surface electrode or nerve needle.

NCS is the application of depolarizing square wave electrical pulses to the skin over a peripheral nerve [4]. The components of NCS are

- Motor nerve action potential
- Sensory nerve action potential
- F-wave

- H-reflex

Sensory nerve conduction study

The application of electrical stimulation to the peripheral nerve and recording pure sensory portion of the nerve. The measurements are velocity, latency(ms) and amplitude(μV).

The purpose of this study is to observe the effects of diabetes on tibial and sural nerve by sensory nerve conduction studies in people with and without diabetes.

AIM AND OBJECTIVES

To find the effect of sensory nerve conduction study of tibial and sural nerve in diabetic and healthy people.

1. To study the effect of tibial nerve conduction in diabetic people.
2. To study the effect of tibial nerve conduction in healthy people.
3. To study the effect of sural nerve conduction in diabetic people.
4. To study the effect of sural nerve conduction in healthy people.
5. To compare nerve conduction study in diabetes and healthy people.

REVIEW OF LITERATURE

A cross-sectional observation study was conducted by **Khadijeh Haji et al 2018** with number of 77 patients 29 men 48 women with type 2 diabetic mellitus at Shariati hospital, Iran. The study is to find out the Nerve Conduction Velocity and its Relationship with Tendon Reflexes in Diabetic Patients. The data of the patient were measured by NCV test and were examined by neurological examination which primarily includes the examination of cranial nerves, motor system, sensory system exteroception, proprioception and tendon reflexes. The recorded data were analysis using software IBM SPSS and the study concluded that people with clinical neuropathy had longer duration of diabetes than people with sub clinical neuropathy.

A prospective case - control study was conducted by **Sunil Kumar et al 2019** at rural teaching and tertiary hospital, Maharashtra, India with the subjects of 65 pre diabetics. The study is to find the Nerve conduction velocity of peripheral and sensory nerves in prediabetic patients. The subjects were included by the value of American diabetic association IFG 100 to 125 mg/dL or IGT 140 to 199 mg/dL for pre diabetic patients and Nerve conduction velocity were performed on right tibial nerve for motor response and right sural nerve for sensory response. The study concluded that there is a significance changes has been noted in pre diabetic patient compared to control group.

Nilda Turgut et al 2004 conducted a study at department of neurology with pediatrics, Turkey. The aim of the study is to evaluate the sensory dorsal sural nerve conduction for children with diabetic. So, there are 36 healthy and 27 diabetic children were participated in this study. Motor and sensory nerve conduction on upper and lower limb was recorded for both children including dorsal

sural nerve. After evaluation, the mean sensory nerve conduction velocity for sural nerve in diabetic and healthy children were 36.68±7.66 m/s and 41.63±5.43 m/s respectively.

A cross-sectional experimental study had conducted by **Hikmet SAÇMACI1 et al 2021** at sivas state hospital in out-patient department at turkey on 2021.The study done to find out the nerve conducting velocity of lower extremities with clinically diagnosed restless leg syndrome patients 32 as experimental and 29 as control group (total 61). The statistical analysis was done and calculated by using SPSS software (version 20.0) and the study concluded with the statical values of the peroneal and sural nerves did not differ but in tibial nerve conduction with the restless leg syndrome patient had lower amplitude and prolongation latency values than of control group with P value of $p=0.003$, $p<0.001$.

An cross sectional observation study was done by **JINDAO et al 2013** at Forth Affiliated hospital of Kunming medical university in China on 2013 with around 500 subjects here 2021 where clinically diagnosed patients and 279 has no symptoms of no peripheral impairment the study is to find out the nerve conduction velocity of peripheral neuropathy patient the statistical analysis of the result data of the measuring used by SBSS software [version 11.5] sikcaco the study revealed that the nerve conduction velocity of the peripheral neuropathy patient has low level of conduction compare to an asymmetrical patients of peripheral neuropathy.

Yunqian Zhang et al 2014 conducted a study for early diagnosis of peripheral neuropathy because early diagnosis is important for management and to prevent risk factors. 500 subjects with diabetes were recruited in this study and they divided into two group – symptomatic (221 subjects) and asymptomatic (279 subjects) and 100 healthy controls also included in this study. Nerve conduction study was done for median nerve, ulnar nerve, common peroneal nerve and posterior

tibial nerve are recorded. After nerve conduction study, the amplitude, latency, motor action potential and sensory nerve conduction velocity are calculated. The results shows that 358 cases have abnormal values in nerve conduction study.

A prevalence study was done by **Ram Babu Singh1 et al 2015** at Manasvi Lakshmi bhai medical college, Jhansi, India. The aim of the study is to investigate the subclinical peripheral neuropathy in newly diagnosed diabetics military patients in that 104 patients for diagnosed by type1 and type 2 diabetics mellitus and MLB opt department and ever examined by pre diabetic neuropathy examination to determine the severity of poly neuropathy and nerve conduction velocity for preferred to lower extremities of tibial nerve sural nerve and superficial layer of peroneal nerve and upper extremities of ulnar nerve ,median nerve are investigated and the result shows that the nerve conduction velocity of [NDDM] patient has low level of conduction with the value of [39.0 +_ 50 m/s]. And finally, study concluded that the sub clinically neuropathy has significantly higher in newly diagnosed diabetics patients.

Observation study done by **Raffack galiero et al 2021** university of campaign lugivaitelli, neples, Italy. The study is to investigate the whole plantar nerve conduction of type2 diabetics military patients for early diagnoses of poly peripheral diabetic neuropathy the include to clinically diagnosed patients of type2 diabetics Miletus WHO there referred to internal medicine. Between the age group of above 18 years the whole plantar nerve conduction was performed by ortho dermic method the nerve conduction was assessed by synergy electromyography machine [SYNPO]. That the reference value of [] as the study concluded that the whole plantar conduction is an efficient tool to diagnose early poly neuropathy in diabetic patients.

A cross-sectional observational study was done by **santhya washnik** on 2020 at Maharashtra university of health science [MUHS],

Nasik, India with 50 clinically diagnosed diabetics military type2 patients and 50 normal healthy subjects the study is to find the, effect of nerve conduction between type2 diabetics military patients. The patients there clinically diagnosed by the criteria of WHO in the level of >=126 mg/dl in pasting and post level was >= 200mg/dl with duration of 20 years and orthodromic sensory nerve conduction study was done by EMG machine as study concluded that the nerve conduction velocity of the type2 diabetics military patients there significantly low level of conduction velocity than healthy subjects with values of [58.16 +- 8.5]

An observational cross sectional analytical study was conducted on Department of Physiotherapy, All India Institute of Physical Medicine and Rehabilitation, India by **Poonam Sepat et al 2020**. The study conducted to find out the diabetic peripheral neuropathy among 40-80 years old age people. There are 50 subjects with type 2 diabetes (Group A) and 50 healthy subjects (Group B) were included. Sensory nerve conduction study for radial, ulnar and median nerve were recorded bilaterally for both groups. The data were analyzed using paired 't' Test within the group and unpaired 't' Test between the group. The result shows that velocity of the median & ulnar nerve was reduced, amplitude of all nerve reduced and prolonged latency of ulnar nerve in type 2 diabetics as compared to the non-diabetics group.

The study was conducted by **Nikhil Rathi et al 2019**. The aim of the study is to find out the nerve conduction changes in prediabetes people. There are 65 prediabetes and 65 controls people were included in this study. They conducted nerve conduction study on right tibial nerve for motor neuropathy and right sural nerve for sensory neuropathy. the parameters evaluated are CMAP, peak to peak amplitude, SNAP, peak to base amplitude and NCV Nerve conduction of sural nerve. After the evaluation, the results shows that there is a significant reduced difference in pre diabetic group compared to control group. The mean motor CMAP for control group is 12.34µV and for pre diabetic group is 8.50µV.

The mean SNAP for control group is 9.03 and for pre diabetic group is 7.69 µV. The mean motor NCV for control group is 62.76 and for pre diabetic group is 51.34 µV. The mean sensory NCV for control group is 52.03and for pre diabetic group is 46.56µV.

The study was conducted to determine the normal and anatomic variation of nerve conduction among Koreans. It is conducted by **Yeong-A Ko, M.D et al 2011** at catholic university of Korea. An observational study with 48 subjects conducted to determine the values of all branches of peroneal nerve. the antidromic sensory study was done with 48 clinically diagnosed healthy subjects. The electrical stimulation applied at the midpoint of medial dorsal cutaneous nerve and the lateral ¼ point between medial and lateral malleoli for intermediate dorsal cutaneous nerve. The results shows that the reference value for first medial dorsal cutaneous nerve is 2.2±0.3/2.9±0.3/9.2±3.1 onset/ peak latency (ms)/ sensory action potential amplitude (µV) respectively, then for second medial dorsal cutaneous nerve are 2.2±0.3/ 2.8±0.3/9.1±3.0. For 2 branches of intermediate dorsal cutaneous nerve are 2.3±0.4/2.9±0.3/8.5±2.8 and 2.3±0.4/3.0±0.4/7.1±2.6.

Chunyang Pang, Huan Yu et al 2023 conducted a study to research the link of vitamin D deficiency and diabetic neuropathy. They collected the data of 1192 T2 diabetes subjects from cohort studies. They used the correlation and RCS to analysis the link between vitamin D and diabetic neuropathy. The result shows that there is a significant level of vitamin D deficiency in subjects with high neurological deficits. Decreased nerve conduction seen in patients with diabetic and vitamin D deficiency compared to subjects without vitamin D deficiency.

The study was conducted to review the effective way to early diagnosis diabetic neuropathy and way to reduce risk early through management. It

is conducted by **Dinesh Selvarajah et al 2019** in University of Sheffield, UK. According to this study, lower limb ulceration is more common patients with longer diabetes in worldwide. There are 70% of diabetes has distal peripheral neuropathy that leads to non-traumatic amputation. Early diagnosis is the important key to prevent future risk factors. NCS is the gold standard diagnosis for peripheral neuropathy.

Khadijeh Haji Naghi Tehrani et al 2020 studied to investigate the nerve conduction velocity in diabetic people in relationship with tendon reflexes. It is an observational-cross sectional study of 77 diabetic people (48 women and 29 men) in the EMG / NCV Department of Shariati Hospital. The parameters evaluated are history of patients, neurological examinations, nerve conduction velocity, amplitude, tendon reflex, vibration and heat test. After NCV the result show that the participants with clinical neuropathy have longer diabetes than normal group.

Kathleen M Galloway1et al 2011 conducted research to investigate the normative values for motor studies recorded from the FHB and sensory studies recorded from medial and lateral plantar nerve. There are 80 women included in this study within 18 to 35 age group. All participants completed screening questionnaire before the NCV. The motor and sensory nerve conduction assessed on non-dominant leg. After research, the normative reference value for motor tibial nerve latency, amplitude and velocity were 4.1 ± 0.9 msec, 8.0 ± 3.0 mV and 45.6 ± 3.4 m/s. For sensory medial plantar nerve were 2.8 ± 0.3 msec, 26.7 ± 10.1 μV, and 41.4 ± 3.5 msec. For sensory lateral plantar nerve were 3.2 ± 0.5 msec, 13.3 ± 4.7 μV, and 44.3 ± 4.0 msec.

Anita Verma et al IJBAP Vol. 2 Issue 1 conducted among 50 diabetic and 50 non diabetic people. Sensory nerve conduction was measured by orthodromic method in 5 nerves- median nerve, radial nerve, ulnar nerve,

superficial peroneal and sural nerve. The results shows that nerve conduction velocity lower in poorly contolled diabetes subjects comparing with well controlled subjects.

A prospective study conducted at Bombay Hospital and Medical Research Centre by **Aarthika Sreenivasan et al 2016.** There are 146 data from healthy subjects aged between 18-60 years were collected. The amplitudes were recorded are 18-30 years were 12.4 μV, 31-40 years were 10.4 μV, 41-50 years were 6.5 μV, 51-60 years 5.3 μV, 61-70 years were 2.9 μV, above 71 years 1.9 μV respectively.

SHOJI HEMMI et al 2007 conducted a study to find out the new method for medial plantar nerve stimulation. There are 64 healthy subjects were included in this study. They recorded sensory medial plantar nerve conduction velocity by placing a surface - active electrode on the sole at a distance of 8 cm and reference electrode placed 3cm proximal to the active electrode. The mean amplitude of normal subjects has higher than the diabetic subjects. There is more advantage of obtaining sensory nerve conduction in six branches derived from medial plantar nerve by this technique.

A study was conducted to evaluate the sensory symptoms by assessing medial plantar and dorsal sural nerve for diabetic people with healthy control by **Kayihan Uluc et al 2008.** They evaluate the medial plantar and dorsal nerve sensory test. 30 diabetic and 30 healthy controls under age 60 years were included in this study. The result shows that evaluating medial plantar and dorsal sural nerve have significant results to find the sensory neuropathy for diabetic people compared with healthy subjects.

The study was conducted at Department of Internal Medicine Kawasaki Medical School by **S Hemmi et al 2010**. The aim of this study is to evaluate the sensory nerve conduction study for diabetic polyneuropathy. They

used different nerve conduction they are surface electrode technique for medial plantar and for digital and interdigital nerve near nerve needle technique used. 25 patients with diabetic polyneuropathy were included in this study. The results shows that there are 60% sensory neuropathy observed in 15 patient's digital and interdigital nerve conduction.

Sissel Løseth et al 2007 conducted a study on medial plantar nerve action potential to collect reference values. There are 98 healthy and 50 patients with diabetic included. The action potential for medial plantar nerve was recorded orthodromically. After nerve conduction, the result shows 39% have reduced velocity and 47% have abnormal action potential overall there are 59% patients have affected.

A C Antunes et al 2000 conducted a study to evaluate sensory nerve action potential, mixed nerve action potential and muscular action potential for medial and lateral plantar nerve. There are 51 healthy adults included in this study. Nerve conduction was recorded bilaterally for all participants. The results shows that 7.8% sensory nerve action potential were not obtained in medial plantar nerve. There is a significant result for nerve conduction study.

The study was conducted to evaluate the correlation between nerve conduction study and diabetic neuropathy symptom scoring by **Jae Young An et al 2008.** There are 19 healthy and 50 diabetics patients included. The sensory nerve conduction was recorded for medial plantar and sural nerve. The results show that both nerve conduction study and diabetic neuropathy symptom scoring needed for neuropathy evaluation.

Alika Sharma et al 2002 conducted a retrospective study to evaluate age related nerve conduction reference data for Indians. 173 subjects aged between 18 and 86 years included. The subjects were allocated into 6 groups. The

reference data after medial plantar nerve conduction are for age 18 to 30 years were 8.7 μV, 31-40 years were 7.5 μV, upto 70 years 1.4 μV.

MATERIALS

Study design

The study was Observational cross sectional analytical study with 100 subjects divided into two groups 50 diabetic and 50 healthy subjects according to their HbA1c level.

Sample size

100 people with age group of 40-60 years (50 diabetic and 50 healthy people)

Sampling method

Simple random sampling

Place of study

Santosh medical college and hospital, Ghaziabad

Duration of study

12 months

ANNEXURE 1

To carry out this study the following measurements were taken in all the subjects: -

- Age
- Height
- Weight
- BMI

- HbA1C
- Consent form
- Sensory nerve conduction – for tibial and sural nerve.

SELECTION OF SUBJECT

INCLUSION CRITERIA

a) People have diabetic according to WHO diagnosis criteria HbA1C $\geq$ 6.5% for Group A and <5.7% for Group B.

b) Duration of diabetes from 1 year to 10 years.

c) Age 40-60 years both male and female

EXCLUSION CRITERIA

a) History of smoking and alcohol drinking

b) Have any previous surgery, injury, cardiovascular problem, neurological disorder, hypertension and any metabolic disorder

c) Patient having malignancy

d) Have any neurological symptoms, ulcers and wound in foot.

e) HbA1C level between 5.7-6.5%(prediabetes).

GROUPS

The present was conducted on 100 subjects (50 diabetes people and 50 healthy people) who are divided into two groups according to their HbA1C level. Age, gender, height and weight matched in both groups.

Group 1 – 50 diabetic people between age 40-60 years and duration of diabetes within 10 years

Group 2 – 50 healthy people between age 40-60 years

METHODOLOGY

To carry out this study the following measurements were taken in all the subjects: -

- Age
- Height
- Weight
- BMI
- HbA1C
- Consent form
- Sensory nerve conduction – for tibial and sural nerve.

ANTHROPOMETRY

- Standing height was recorded in Cm without shoes and with light clothes on a wall mounted measuring tape to nearest of cm. The range of scale was 140-190 cm in standing.
- Body weight was recorded in Kg with shoes off, in minimal clothing by using weighting machine.
- BMI was calculated by the formula of Wt (in Kg) and Ht (in meters). BMI = Wt / Ht^2

Age, Height and Weight were matched in both groups

PROCEDURE

SENSORY NERVE CONDUCTION STUDY

Sensory nerve conduction study was done using EMG diagnostic device. The EMG machine is designed to respond to voltages of 0.5μV to 10mV in amplitude, and from 1to 30,000Hz in frequency.

The antidromic sensory nerve conduction demonstrates the physiological properties of sensory nerve. The sensory nerve conduction study for sural and tibial (medial and lateral plantar nerve) latency (ms), amplitude (μV) and velocity (m/sec) recorded.

The room temperature was maintained above 32°c. The sensitivity was kept between 10-20μV and frequency 1 Hz kept in all subjects with stimulation duration at 0.05ms.

The subjects were in supine position and relaxed. The nerve conduction test done on dominant leg. The skin temperature of leg maintained between 32-36°c by applying moist heat pack on the foot.

Sural sensory nerve conduction

The active recording electrode placed between the lateral malleolus and the Achilles tendon; the reference electrode attached distal to the active electrode. The stimulation was placed below the gastrocnemius muscle 14 cm distance from the active electrode. After waveform, the latency and amplitude were calculated and recorded for outcome.

Tibial sensory nerve conduction

For tibial nerve both medial and lateral plantar were recorded. The active recording electrode placed posterior to the medial malleolus, and the reference electrode placed 3 cm proximal to the active electrode. The stimulation point for the medial plantar sensory nerve was placed between the first and second metatarsals 12 cm distal to the recording electrode. The stimulation point for the lateral plantar sensory nerve was between the fourth and fifth metatarsals 14 cm distal to the active recording electrode. After waveform, latency and amplitude were calculated and recorded for outcome.

RESULTS

After collecting the data, the data were assessed for normality test using Shapiro-Wilk normality test. Then the data will be analyzed using Z test.

Using the formula

$$Z=(X1-X2)/sqrt((s1_2/n1) + (s2_2/n2))$$

Table 1.1 comparison of sural nerve velocity between Group A and Group B.

GROUP	A	B
Mean	37.97 m/s	48.46 m/s
SD	7.22	11.304
Z value	5.5301	
'p' value	<0.0001	

Graph 1.1 comparison of sural nerve velocity between Group A and Group B.

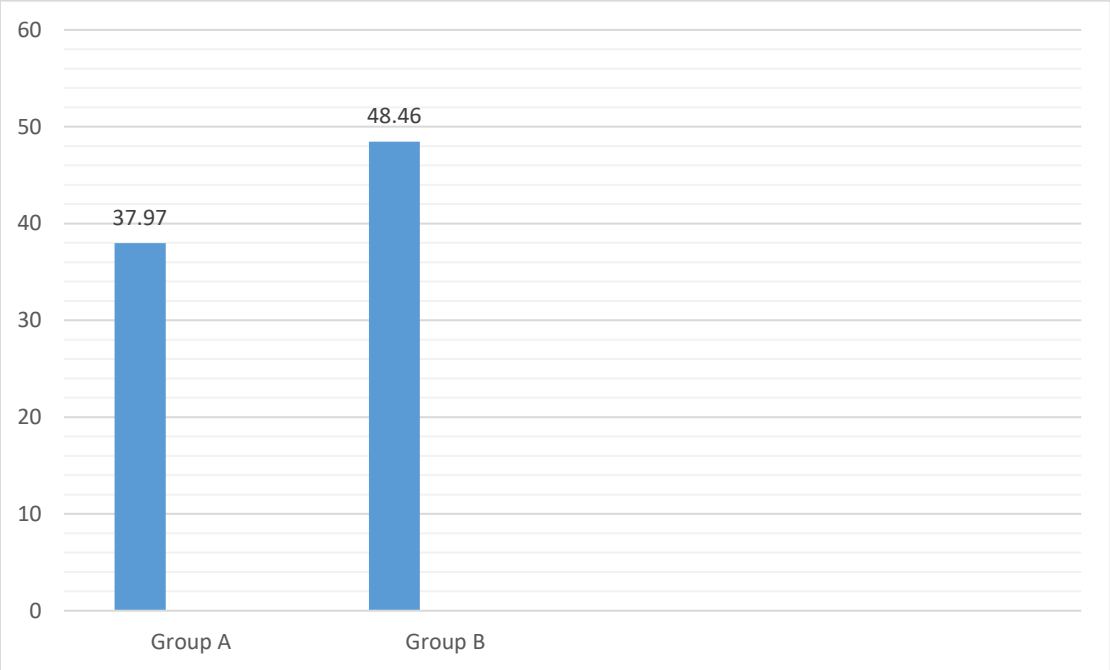


Table 1.2 comparison of medial plantar nerve velocity between Group A and Group B.

GROUP	A	B
Mean	30.409 m/s	41.18 m/s
SD	5.34	8.87
Z test vale	7.35	
'p' value	<0.0001	

Graph 1.2 comparison of medial plantar nerve velocity between Group A and Group B.

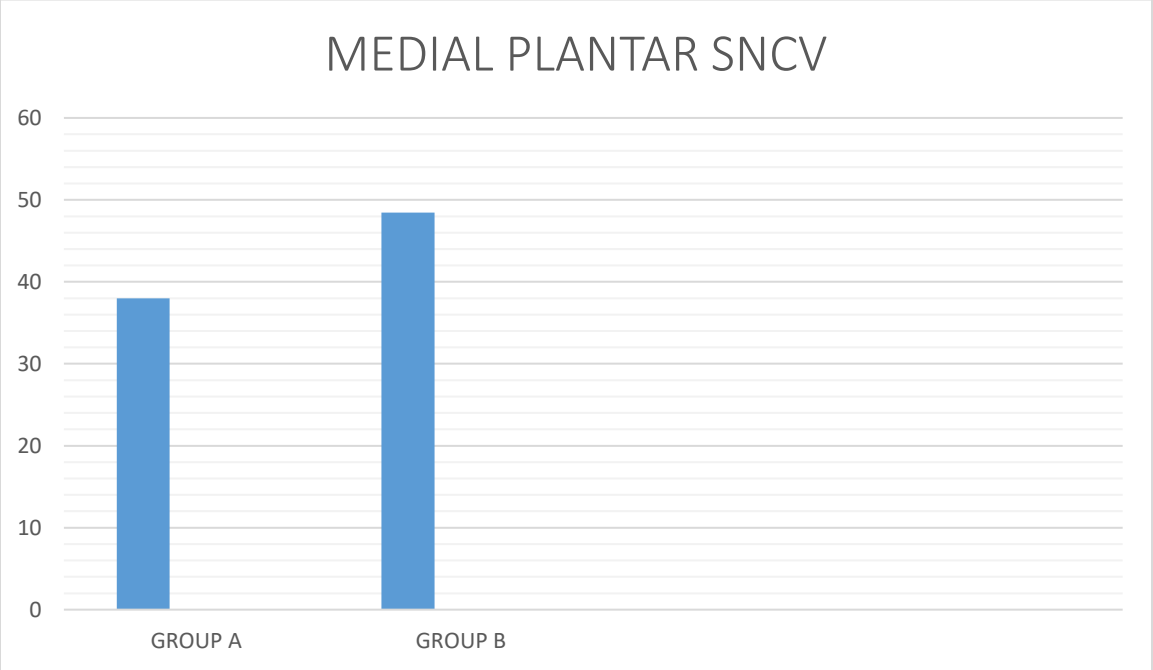


Table 1.3 comparison of lateral plantar nerve velocity between Group A and Group B.

GROUP	A	B
Mean	33.97 m/s	44.996 m/s
SD	2.86	11.57
Z test value	6.54	
'p' value	<0.0001	

Graph 1.3 comparison of lateral plantar nerve velocity between Group A and Group B.

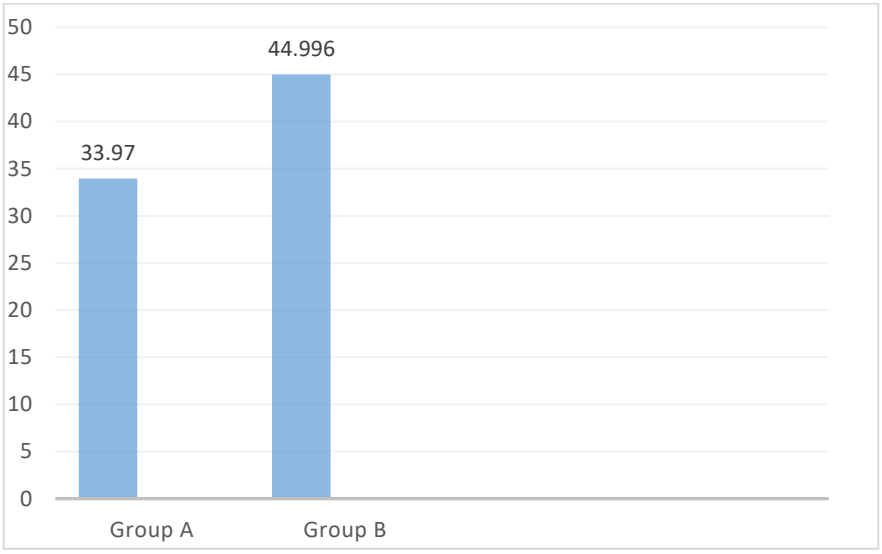
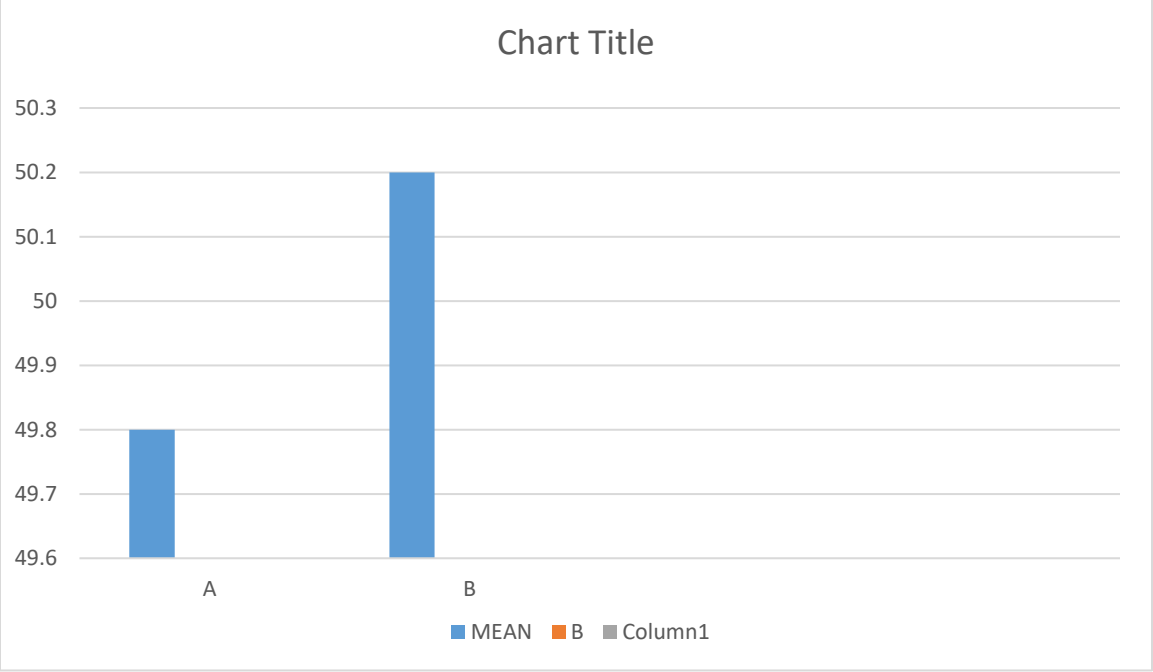


Table 1.4 AGE DISTRIBUTION

GROUP	MEAN	SD
A	49.8	7.203
B	50.2	5.606

Graph 1.4 comparison of mean age between Group A and Group B.



DISCUSSION

The peripheral neuropathy is the most common problem for people above 40 years of age. The numbness over feet and tingling sensation are the first symptom of neuropathy. Its common in old age people and people with diabetes. In current years, diabetes is the steadily raising metabolic disorder in worldwide among population. Diabetes increases with number of people affecting in all region. It has both long and short effects. Like long term effects are retinopathy, neuropathy, cataracts, nephropathy, cardiac disease, CVA etc., 8-20% of diabetic people have neuropathic pain. There is increasing evidence that patients with milder degrees of abnormal blood glucose have neuropathy.

Neuropathy affect people with diabetes, pre-diabetes and without diabetes. The nerve conduction decreases with increasing age group people and people with high BMI due to Schwann cell damage and demyelination. There are lots of research conducted using nerve conduction study among diabetic people and non-diabetic people. But for tibial and sural sensory is not common. Age and duration of diabetes impact on tibial and sural nerve not clear.

The study is conducted to find the effect of sensory nerve conduction of tibial and sural nerve in diabetic and healthy people. This is an Observational cross sectional analytical study with 100 subjects divided into two groups 50 diabetic and 50 healthy people. The

subjects were selected according to their HbA1C level by WHO diagnosis criteria HbA1C $\geq$ 6.5% for Group A and <5.7% for Group B. Both male and female within 40 to 60 years were included. After that subjects were divided into two group by simple random sampling method. The sensory nerve conduction for tibial (medial planar & lateral plantar) and sural was recorded for both groups. During NCS latency, amplitude was recorded after that nerve conduction velocity was calculated.

The result shows that there is a significant decrease in nerve conduction velocity for both nerves in patient with diabetes that healthy. Comparing to sural nerve that tibial nerve has more affected and decrease in nerve conducting velocity with mean value of 37.97 m/s, 30.409 m/s and 33.97 m/s sural, medial plantar and lateral plantar nerve respectively. So, there is significant difference in nerve conduction velocity in subjects with diabetic and non-diabetic people with ‘p’ value of <0.0001. Therefore, neuropathy symptoms increase with longer duration of diabetes and with older age.

CONCLUSION

The present study entitled sensory nerve conduction velocity study for tibial and sural nerve among diabetic and healthy people was conducted in the department physiology, Santosh medical college & hospital, Ghaziabad.

There are 100 subjects were included according their HbA1C level they were divided into two group A (Diabetic) & B (Healthy subjects) by simple sampling method. Each group has 50 subjects. After selection, neurological examination and history were collected from the patients. Then nerve conduction velocity for sural and tibial nerve was recorded.

After results, the study concluded that people with high glucose have high risk of neuropathy. Age and BMI are slightly increased in both groups. The tibial nerve affected more than comparing to sural nerve in both groups.

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PROFORMA

S no Date

Name

Age

Gender

Occupation

Address

Height

Weight

Body built

Medical History

Socio economic status

General examination

Warmth

Skin color

Swelling / edema

Pain examination

Type

Nature

Duration

Side & site of pain

Neurological examination

Heat test

Vibration test

Reflex

Dermatome

Myotome

Sensory examination

Motor examination

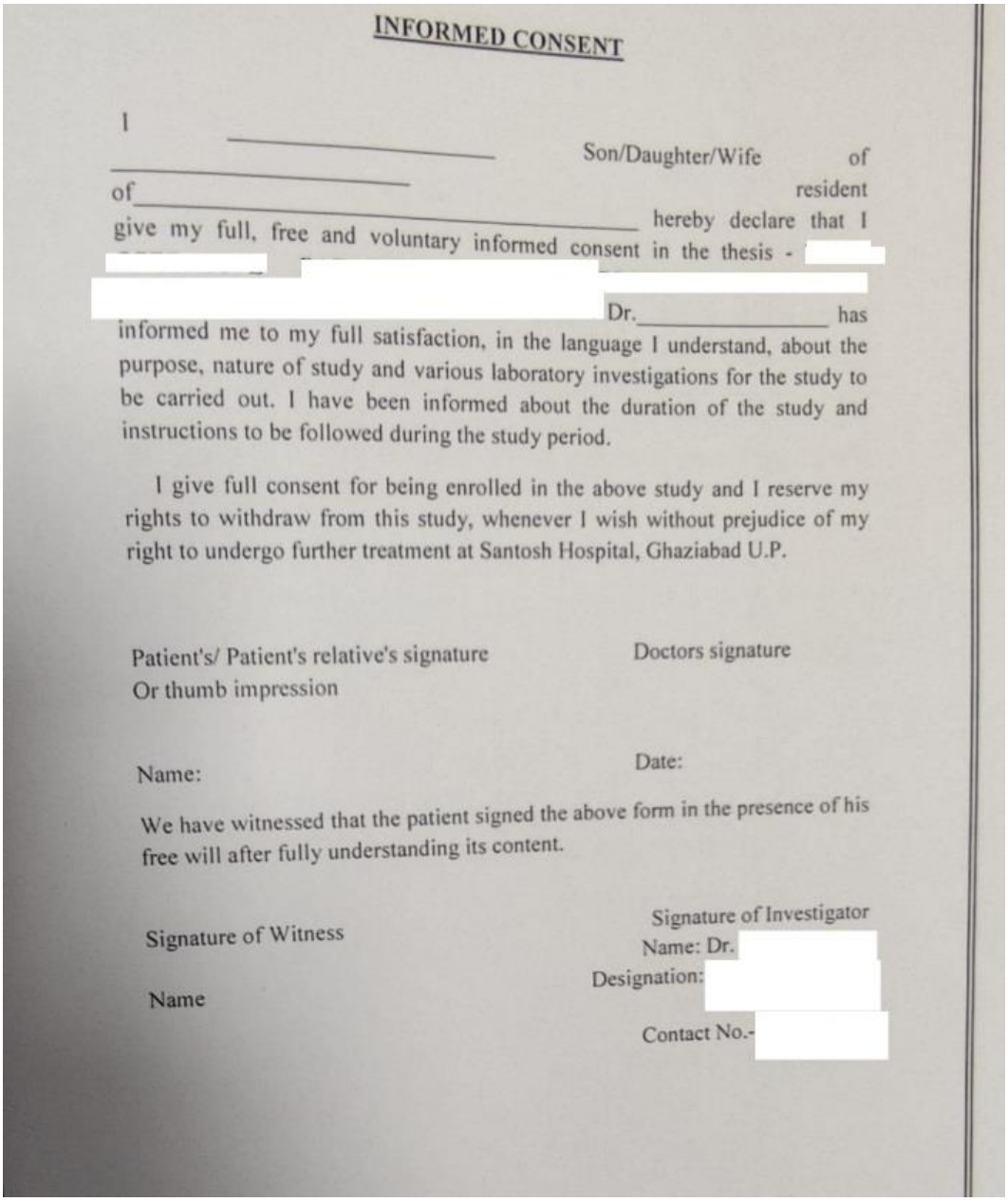
ROM

Muscle tone

HbA1C

SANTOSH DEEMED TO BE UNIVERSITY (GHAZIABAD)

INFORMED CONSENT ENGISH



INFORMED CONSENT

I _____ Son/Daughter/Wife of _____ of _____ resident of _____ hereby declare that I give my full, free and voluntary informed consent in the thesis - [redacted] Dr._____ has informed me to my full satisfaction, in the language I understand, about the purpose, nature of study and various laboratory investigations for the study to be carried out. I have been informed about the duration of the study and instructions to be followed during the study period.

I give full consent for being enrolled in the above study and I reserve my rights to withdraw from this study, whenever I wish without prejudice of my right to undergo further treatment at Santosh Hospital, Ghaziabad U.P.

Patient's/ Patient's relative's signature Or thumb impression

Doctors signature

Name:

Date:

We have witnessed that the patient signed the above form in the presence of his free will after fully understanding its content.

Signature of Witness

Name

Signature of Investigator

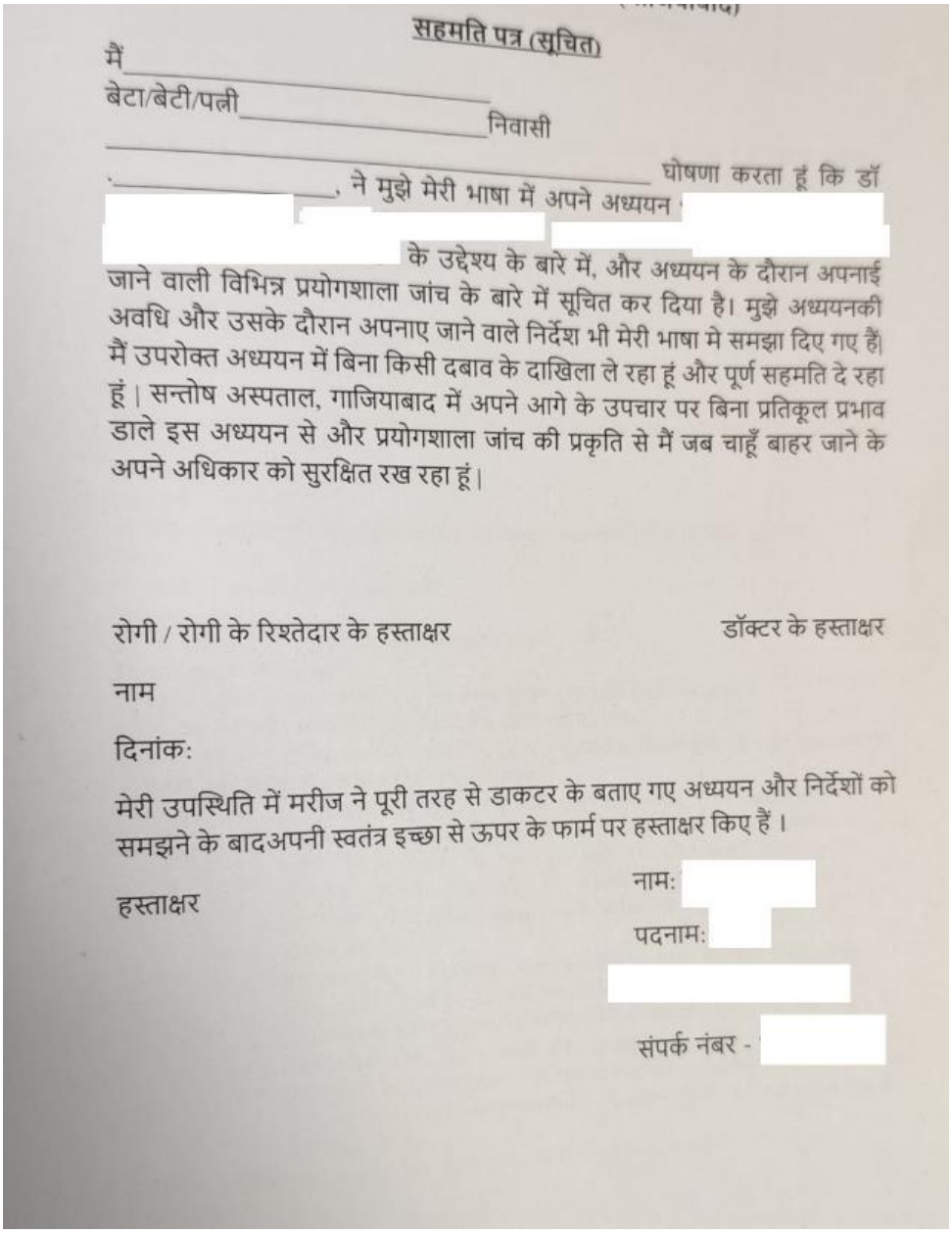
Name: Dr. [redacted]

Designation: [redacted]

Contact No.- [redacted]

SANTOSH DEEMED TO BE UNIVERSITY (GHAZIABAD)

INFORMED CONSENT HINDI



सहमति पत्र (सूचित)

मैं _____

बेटा/बेटी/पत्नी _____ निवासी

_____ घोषणा करता हूं कि डॉ _____, ने मुझे मेरी भाषा में अपने अध्ययन _____ के उद्देश्य के बारे में, और अध्ययन के दौरान अपनाई जाने वाली विभिन्न प्रयोगशाला जांच के बारे में सूचित कर दिया है। मुझे अध्ययनकी अवधि और उसके दौरान अपनाए जाने वाले निर्देश भी मेरी भाषा मे समझा दिए गए हैं| मैं उपरोक्त अध्ययन में बिना किसी दबाव के दाखिला ले रहा हूं और पूर्ण सहमति दे रहा हूं | सन्तोष अस्पताल, गाजियाबाद में अपने आगे के उपचार पर बिना प्रतिकूल प्रभाव डाले इस अध्ययन से और प्रयोगशाला जांच की प्रकृति से मैं जब चाहूँ बाहर जाने के अपने अधिकार को सुरक्षित रख रहा हूं|

रोगी / रोगी के रिश्तेदार के हस्ताक्षर

डॉक्टर के हस्ताक्षर

नाम

दिनांक:

मेरी उपस्थिति में मरीज ने पूरी तरह से डाकटर के बताए गए अध्ययन और निर्देशों को समझने के बादअपनी स्वतंत्र इच्छा से ऊपर के फार्म पर हस्ताक्षर किए हैं ।

हस्ताक्षर

नाम:

पदनाम:

संपर्क नंबर -

DETAILS OF PATIENT INFORMATION SHEET

HUMAN RESEARCH PROPOSAL

1. Identifying Data

Name of Researcher:

Department:

Title of Project:

2. Description of Human Subjects Safeguards and Rights:

a) Possible psychological of physical risk of discomfort, involved in research If Yes/No (if no, skip time B)
If yes, answer the following

Why necessary?

1. To have the common disease
2. Specificity and sensitivity of the treatment

b) Make sure the following questions are answered in your research proposal on collection of Data:
1) When will it take place?

2) What length of time needed for complete examination of the patient?

3) What period of the time needed?

4) Which specific place within institution?

5) How much population required including number of subjects?

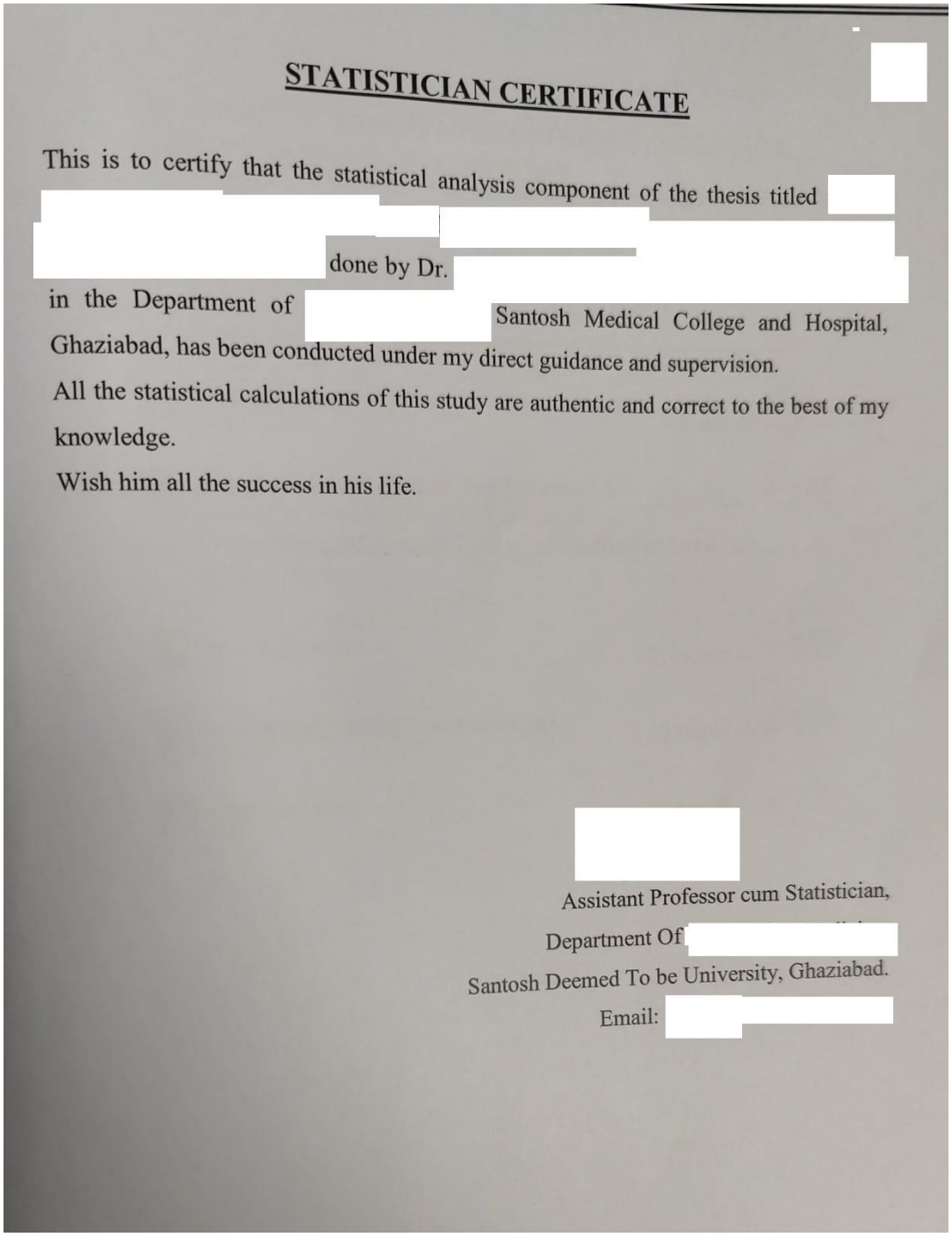
6) Name of instrument to be used for data collection?

7) Methodology to be used (write details)?

c) Will subjects be given research results if they so request?
Yes / No

LETTER OF ETHICAL CLEARANCE FOR DISSERTATION FROM REGISTRAR OFFICE

STASTICIAN CERTIFICATE



STATISTICIAN CERTIFICATE

This is to certify that the statistical analysis component of the thesis titled [redacted] done by Dr. [redacted] in the Department of [redacted] Santosh Medical College and Hospital, Ghaziabad, has been conducted under my direct guidance and supervision.

All the statistical calculations of this study are authentic and correct to the best of my knowledge.

Wish him all the success in his life.

[redacted]

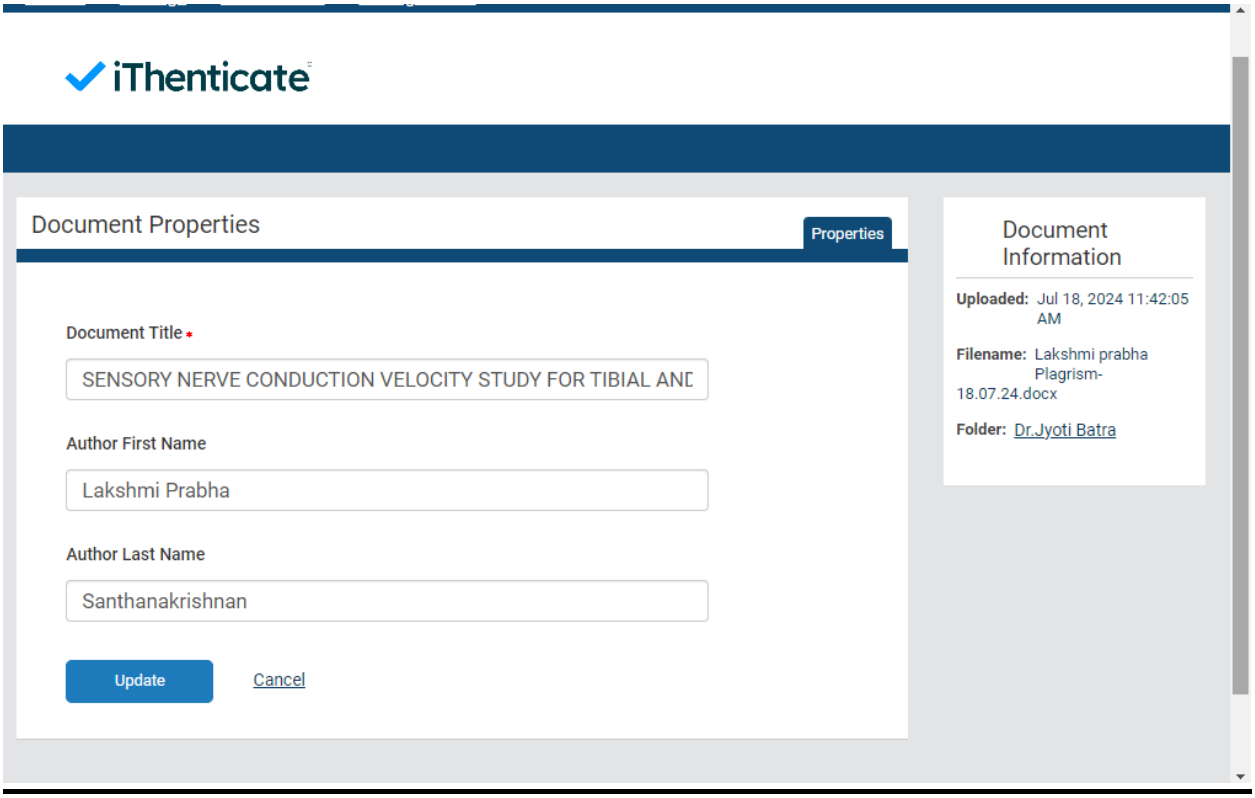
Assistant Professor cum Statistician,

Department Of [redacted]

Santosh Deemed To be University, Ghaziabad.

Email: [redacted]

PLAGIARISM CERTIFICATE



MASTER CHART

GROUP- A – DIABETIC SUDJECTS

SENSORY NERVE CONDUCTION VELOCITY

S NO	SURAL NERVE	MEDIAL PLANTAR	LATERAL PLANTAR
1.	36.84	29.27	31.11
2.	43.75	30.77	33.33
3.	41.18	48	34.15
4.	29.78	37.5	38.89
5.	43.75	28.57	31.11
6.	56	35.29	38.89
7.	33.33	34.29	35.897
8.	58.3	42.86	41.18
9.	36.84	30.77	31.11
10.	31.11	28.58	29.78
11.	35.897	38.71	35.897
12.	29.78	25.53	33.33
13.	33.33	25.53	31.11
14.	28.57	26.67	34.15
15.	35.897	28.57	34.15
16.	36.84	30.77	36.84
17.	38.89	28.57	29.78
18.	53.84	30.77	36.84
19.	45.16	34.29	33.33
20.	35.897	26.67	36.84
21.	41.18	28.57	29.78
22.	43.75	30.77	34.15

23.	38.89	46.15	35.897
24.	31.11	26.67	33.33
25.	29.78	26.67	34.15
26.	35.897	31.58	35.897
27.	36.84	28.57	29.78
28.	31.11	25.53	33.33
29.	38.89	26.67	31.11
30.	50	34.29	36.84
31.	36.84	33.33	35.897
32.	37.84	30.77	36.84
33.	28.57	30.77	31.11
34.	35.897	35.29	35.897
35.	33.3	30.77	29.78
36.	38.89	25.53	33.33
37.	41.18	26.67	35.897
38.	37.84	34.29	36.84
39.	50	35.29	38.89
40.	31.11	25.53	35.897
41.	28.57	24.49	33.33
42.	35.897	26.67	33.33
43.	33.3	24.49	31.11
44.	43.75	28.57	31.11
45.	50	30.77	34.15
46.	38.89	26.67	35.897
47.	31.11	25.53	33.33
48.	28.57	28.57	28.57
49.	36.84	24.49	34.15
50.	37.84	24.49	31.11

GROUP- B (NON-DIABETIC SUDJECTS)

SENSORY NERVE CONDUCTION VELOCITY

S NO	SURAL NERVE	MEDIAL PLANTAR	LATERAL PLANTAR
1.	50	46.15	42.42
2.	60.9	42.86	38.89
3.	45.16	37.5	47.17
4.	36.76	36.36	50
5.	42.42	42.86	60.87
6.	31.11	50	50
7.	38.88	36.36	42.42
8.	43.75	33.33	47.17
9.	58.33	57.14	45.16
10.	50	50	60.87
11.	56	52.17	58.33
12.	41.18	36.36	50
13.	53.84	38.71	36.84
14.	60.9	57.14	50
15.	73.68	50	73.68
16.	43.75	35.29	31.1
17.	58.33	48	47.17
18.	36.84	31.58	29.79
19.	42.42	35.29	47.17
20.	45.16	52.17	47.17
21.	50	33.33	60.87
22.	58.33	52.17	36.84
23.	41.18	35.29	73.68
24.	42.42	35.29	47.17

25.	73.68	52.17	60.87
26.	31.11	31.58	31.1
27.	38.88	52.17	36.84
28.	50	37.5	38.89
29.	36.84	26.67	36.84
30.	53.84	37.5	47.17
31.	43.75	35.29	43.75
32.	36.84	36.36	31.1
33.	45.16	35.29	33.3
34.	73.68	48	43.75
35.	58.33	26.67	29.79
36.	42.42	48	60.87
37.	41.18	35.29	36.84
38.	42.42	38.71	47.17
39.	50	35.29	43.75
40.	56	42.86	47.17
41.	43.75	36.36	43.75
42.	58.33	25.53	31.1
43.	73.68	50	38.89
44.	58.33	57.14	73.68
45.	31.11	42.86	43.75
46.	38.88	26.67	36.84
47.	43.75	57.14	43.75
48.	56	34.29	36.84
49.	29.78	36.36	27.45
50.	53.84	48	29.79